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Memo on present and future potential scale of utilization of analog-to-digital facilities in the medical school.

Over a period of a few weeks, Professor Lincoln E. Moses of the Statistics Department interviewed several research workers at the medical school. Typically, these discussions lasted for about an hour. He found many investigators expressing a direct interest in the immediate or near future availability of analog-to-digital equipment for making available the services of the Computation Center. These discussions will be summarized by subject area.

Heart

David Rytand, Professor of Medicine, has long been interested in atrial fibrillation. This disease is characterized by an irregular E.C.G. and by a lack of coordination between the upper and lower heart. By means of taking readings on high-speed recording apparatus during open heart surgery, Dr. Rytand has obtained records which should be valuable in testing models for the mechanism of atrial fibrillation. A central problem in all this is the question of data reduction of this analog record. He would make immediate and probably extensive use of such facilities as soon as they became available.

J. von der Groben and Dr. J. G. Toole have for some years been engaged in analysing E.C.G. records by means of choosing orthogonal axes and getting a readily interpreted vector representative of the heart beat. In this work, some of which is in clinical use (diagnosis of certain lesions) they have necessarily done a great amount of analog-to-digital data reduction, much of it by hand. They anticipate that their research work in this area will continue, embracing more and more particular diagnostic problems. The exploratory analysis, testing of trial hypotheses and so forth would be greatly facilitated by the presence of good equipment of the type contemplated. They would make immediate and extensive use of such equipment.

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Molecular Biology

In the Biophysics Laboratory, Professor Howard Pattee is engaged upon developing an X-ray diffraction technique and hardware for studying the structure of macromolecules. It is more than probable that in the near future, he will have brought this work to such a point that two kinds of problem relevant to the project proposal will come out of his lab. The first of these is a need for digital-to-analog equipment for inferring contour maps of a sort from an analytical model. The second is a need for analog-to-digital equipment for processing the analog data which arise out of scanning the X-ray micrographs preparatory to numerical analysis.

Genetics

Professor Lederberg has important research hypotheses, the testing of which depends upon verifying the occurrence or non-occurrence of events having probabilities such as 10^{-6} . The data consist of cultures or microscope slides or other such systems which must be read by human observers. On so large a scale this is out of practical reach. Automation of such reading process by electronic devices on to magnetic tape, for example, leads to large scale utilization of exactly the sort of facilities under consideration. In the long run, of course, as such automation problems are solved, they would be handled by specially developed, less versatile, more efficient and less expensive special purpose equipment, but the developmental stages require large capacity, general purpose equipment.

Professor Lederberg's associate, Dr. Levinthal, is the center of an electronic engineering group in the medical school and it is his view that the presence of this group will increase the number and variety and use of analog-data-producing equipment and research programs in the medical school. This

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predisposes him to regard as desirable, at least in the foreseeable future, the provision of large capacity, high quality A-D equipment. He also feels that as the Lederberg-Levinthal exobiology program develops, it will almost necessarily generate data calling for the use of such equipment.

Neurological Research

Dr. Karl Pribram is doing research on learning and generates both digital and analog data. His emphasis at the present time is on experiments leading to digital data and this is partly because of the lack of analog-to-digital equipment. He stated that if the Computer Center now had the equipment under consideration, he would immediately apply for the recording equipment needed at the laboratory and within three months would be using it heavily with E.E.G. and other similar kinds of data.

Dr. Frank Morrell's research program is largely based on the E.E.G. and he was very outspoken in his belief that this equipment is desirable to his research objectives and that he would make use of it. He welcomed the choice of equipment items which may eventually allow the use of real time.

Dr. Keith Killam, a psycho-pharmacologist, is associated with Dr. Pribram and Dr. Morrell in an application to the N.I.H. for a small scale analog-to-digital facility, complete with digital computer and digital-to-analog conversion unit, etc. He feels that such a small scale installation has advantages of simplicity, (making entry of non-mathematical biologists into this kind of work easier), flexibility, (being easier to use in exploratory work at the laboratory) and convenience (being under the control of the research group using it). At the same time, he made it clear that he considers the application in question to be complementary to, rather than competitive with, the equipment for which his group has applied. He anticipates confidently that he will make considerable use of the large capacity facilities which are the subject of this request, as the use of the small scale equipment he has already undertaken to obtain leads to clearly formulated hypotheses and schemes of analysis.